

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460



OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

MEMORANDUM

DATE: December 4, 2019

SUBJECT: **Fluindapyr:** Summary of Hazard and Science Policy Council (HASPOC) Meeting on November 26, 2019: Recommendations on the Need for an Immunotoxicity Study, Dermal Toxicity Study, and a Comparative Thyroid Assay.

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40 CFR: N/A

FROM: Janet Camp, Executive Secretary
HASPOC
Health Effects Division (7509P)

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THROUGH: Hannah Pope-Varsalona, PhD, Co-Chair
Brian Van Deusen, Co-Chair
HASPOC
Health Effects Division (7509P)

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TO: Whang Phang, Ph.D.
Thomas Moriarty, Branch Chief
Risk Assessment Branch III (RAB3)
Health Effects Division (7509P)

MEETING ATTENDEES:

HASPOC Members: Gregory Akerman, Evisabel Craig, Matthew Crowley, Angela Gonzales, Kelly Lowe, Michael Metzger, Hannah Pope-Varsalona*, Brian VanDeusen*
*Co-chair

Presenter: Whang Phang

Other Attendees: Moana Appleyard, Laura Bacon, Janet Camp**, Heriberto Deleon, Sarah Dobreniecki, Jeremy Leonard, Ruthanne Loudon**, Robert McGovern, Tom Moriarty
**Secretary

I. PURPOSE OF MEETING

Risk Assessment Branch III (RAB III) is preparing a risk assessment for a new fungicide active ingredient (a.i.), fluindapyr, for agricultural and residential uses. Based on the current 40 CFR Part 158 data requirements, an immunotoxicity study is required for fluindapyr; the registrant submitted a data waiver request for an immunotoxicity study (MRID 50518126). A submitted dermal toxicity study was classified as unacceptable due to faulty application methods. An acceptable dermal toxicity may be needed. In addition, when there is concern for significant thyroid toxicity, HED is required to determine the need for a comparative thyroid assay (CTA). The Hazard and Science Policy Council (HASPOC) met on November 26, 2019 to discuss the need for an immunotoxicity study, a dermal toxicity study, and a CTA to support the proposed uses of fluindapyr.

II. SUMMARY OF USE PROFILE, EXPOSURE, AND HAZARD CONSIDERATIONS

a. Use and Exposure Profile

Fluindapyr belongs to the succinate dehydrogenase inhibitors (SDHI) fungicide group 7, and the pyrazole carboxamide chemical group as classified by the Fungicide Resistance Action Committee (FRAC). The mode of fungicidal action for this class of compound is by binding to the ubiquinone binding site of the SDH enzyme leading to blockage of the tricarboxylic acid (TCA) cycle at the level of succinate and fumarate oxidation. Fluindapyr is proposed for postemergence foliar applications to cereal grains, except rice (crop group 15); small vine climbing fruit, except fuzzy kiwifruit (subgroup 13-07F); soybean; tree nuts (crop group 14-12); and turf and ornamentals (including greenhouse). Fluindapyr can be applied by both aerial and ground application equipment. Fluindapyr products are formulated as soluble concentrates with single maximum application rates ranging from 0.07 lb ai/A (corn, soybean, wheat) to 0.27 lb ai/A (turf). Clothing and personal protective equipment (PPE) listed on the label are a single layer of clothing plus gloves. Based on the use sites and application methods, short- and intermediate-term occupational handler exposures (dermal and inhalation), as well as post-application dermal exposures are anticipated. Additionally, short-term residential handler (dermal and inhalation) and post-application dermal or incidental oral (children only) exposures are anticipated. Finally, dermal and incidental oral exposures are anticipated from spray drift.

b. Toxicity Profile

The oral subchronic (28-day and 90-day) toxicity studies in rats and mice showed no adverse effects up to the highest dose tested (330 mg/kg/day for rats and 1339 mg/kg/day for mice). In contrast, in the 90-day dog study (capsule), adverse liver effects included hepatocellular hypertrophy, increased liver weights, and bile duct hyperplasia with correlated increases in alkaline phosphatase (ALP), alanine aminotransferase (ALT), and gamma glutamyl transferase (GGT) at the highest dose tested (200 mg/kg/day). The adverse liver effects were progressive in

dogs with respect to the duration of exposure as indicated by the data of the one-year dog study (capsule). For the one-year toxicity study in dogs, fluindapyr produced similar adverse liver effects at a dose five times lower than that of the subchronic study (40 mg/kg/day compared to 200 mg/kg/day). Most of the clinical pathological changes were statistically significant and above the reference values for common chemistry determinations in adult dogs¹. Adverse liver effects were also seen in the mouse carcinogenicity study at a higher dose level (412 mg/kg/day); the effects consisted of increased incidence of hepatocellular alterations (basophilic, eosinophilic, vacuolated), necrosis, and pigmented macrophages. No adverse liver effects were seen in the rat combined chronic/ carcinogenicity study at the limit dose (1000 mg/kg/day). No compound-related increase in tumor incidence were found in the rat chronic and carcinogenicity study, whereas in the mouse carcinogenicity study, there was a slight increase in hepatocellular adenomas (12%) relative to the controls (6%) in male mice only. The mutagenicity battery showed fluindapyr was not genotoxic.

In the acute neurotoxicity study, a decrease in total and ambulatory motor activities and in rearing was seen at approximately five hours after dosing (time for peak plasma concentration); however, these were not seen in the subchronic neurotoxicity study. No additional functional observation (FOB) parameters were affected, and no neuropathological findings of both central and peripheral nerves were observed.

With *in-utero* exposure, fluindapyr did not produce any adverse effects in either rat or rabbit fetuses, and no increase in susceptibility was seen in developmental toxicity in rats and rabbits. Both rat and rabbit developmental studies were tested at or approaching the limit dose (1000 mg/kg/day). In the reproduction study, in parental animals, fluindapyr induced an increase in thyroid follicular hypertrophy/hyperplasia. It also induced adverse effects on a host of reproductive parameters, which included corpora lutea vacuolation, increase epithelium mucification, increase anestrus epithelium of the vagina, delayed vaginal opening, and decrease in antral follicle counts, increase in seminal vesicle weight, decreases in ovary and uterine weights, and attenuated endometrium. It also produced adverse offspring effects as indicated by decreases in F1 and F2 pup body weights in both sexes; thymus and spleen weights were also decreased. The parental, reproductive, and offspring effects all occurred at the same dose levels. Therefore, there was also no increase in susceptibility.

Fluindapyr exhibited low acute toxicity with oral, dermal, and inhalation dosing resulting in Toxicity Category III for all three routes of exposure. It was not an eye or dermal irritant, but it produced moderate skin sensitization with local lymph node assay.

III. STUDY WAIVER REQUESTS

a. Immunotoxicity

- 1. Indicators for potential immunotoxicity:** A decrease in thymus and spleen weights was seen in pups at 142 mg/kg/day in the two-generation reproduction toxicity study in rat

¹ Klassssen, JK (1999). Reference Values in Veterinary Medicine. Laboratory Medicine. Volume 30, Number 3, March 1999.

where decrease in pup body weight was also seen (Table 1). This change was not found in adults or in any other studies. No other correlated effects were found.

Table 1. Indicators for Immunotoxic Potential for Fluindapyr.	
Parameter	Findings
Hematology Indicators (WBC changes)	None
Clinical Chemistry Indicators (A/G Ratio)	None
Organ Weight Indicators (Spleen, Thymus)	Yes
Histopathology Indicators (Spleen, Thymus, Lymph nodes)	None
Toxicity Profile (Target Organ)	Liver (rat, mouse, and dog)

- 2. Evidence for immunotoxicity from SAR chemicals - Retrospective analysis:** As mentioned before, fluindapyr belongs to SDHI fungicide group 7, and pyrazole carboxamide chemical group as classified by the FRAC. There are 7 structurally-related pyrazole-carboxamides in the HED database including benzovindiflupyr, bixafen, fluxapyroxad, isopyrazam, penflufen, penthiopyrad, and sedaxane. Immunotoxicity studies were conducted with six of these chemicals and the results are shown in Table 2. Penthiopyrad was the only structurally related compound that showed mild immunotoxicity effects; however, the effects were observed in the presence of systemic toxicity and only at the highest dose tested (1000 mg/kg/day) which was above the critical NOAEL used for risk assessment.

Table 2. Immunotoxicity Results for Structurally Related Compounds.				
Chemical	Immunotoxicity Study Results		% similarity to fluindapyr (ChemID)	References
	Finding	NOAEL/LOAEL (mg/kg/day)		
Benzovindiflupyr	Not immunotoxic	97.1(HDT)/ Not achieved	60%	MRID 48604461
Bixafen	Waived		70%	TXR 0057713
Fluxapyroxad	Not immunotoxic	1323 (HDT)/ Not achieved	70%	MRID 47923633
Isopyrazam	Not immunotoxic	1356 (HDT)/ Not achieved	75%	MRID 48347201
Penflufen	Not immunotoxic	756/(HDT)/ Not achieved		MRID 48023837
Penthiopyrad	Mouse: ↓ plaque-forming	250/1000	68%	MRID 47614945
	Rat: ↓ spleen weight	171/700		MRID 47614944
Sedaxane	Not immunotoxic	1080 (HDT)/Not achieved	70%	MRID 47473405

- 3. Risk assessment considerations:** The points of departure (PoDs) or NOAELs selected for risk assessment for fluindapyr (Table 1 of Appendix A) are rather low (16-250x lower) in comparison to LOAEL for the only structurally related chemical (penthiopyrad) that shows immunotoxicity at the highest dose tested (1000 mg/kg/day for mice and 700 mg/kg/day for rats). The most sensitive effects in the fluindapyr hazard database are , and an immunotoxicity study is not expected to provide a lower PoD for risk assessment, and the selected PoDs are expected to be protective of any potential immunotoxic effects.

Based on a WOE approach, considering all the available fluindapyr hazard and exposure data, the HASPOC recommends that an immunotoxicity study is not required at this time. This approach included the following considerations: (1) the target organs for fluindapyr are the liver and the female reproductive organs; (2) the toxicology database for fluindapyr does not

reveal any significant evidence of treatment-related effects on the immune system. The overall weight of evidence suggests that this chemical does not directly target the immune system; (3) structurally related compounds indicate that if fluindapyr would produce immunotoxicity it would be near or above the limit dose, and (4) the POD from the most sensitive endpoints are selected for assessing risks from chronic exposure and it is unlikely that an immunotoxicity study would identify a more sensitive endpoint.

b. Dermal Toxicity Study

The registrant submitted a 28-day dermal toxicity study in rats (MRID 50518097); the study was classified as unacceptable due to deviation from guideline recommendations. Ideally, since the test substance was a powder, it would be most appropriate to dissolve it or suspend it in a suitable vehicle, which would not elicit any toxicity. The test article should then be applied to the application site. However, the application method as presented in the study report consisted of placing the powder test material on a piece of gauze (without moistening it) and applying this as is to the application site. No adverse effect was reported in the study report; however, the faulty application method would have impacted the outcome of the study by reducing the potential for absorption of the test substance into the test animal. It was considered as a major deficiency.

At this time, for dermal exposure assessment, the toxicity endpoint was derived from the two-generation reproduction study with a PoD of 30 mg/kg/day as shown in Table A.1. A dermal absorption factor (DAF) (17%) was extrapolated as the most protective from a range of DAF's (5.4% - 17%) for structurally related chemicals. The body weight employed for this assessment was 69 kg as the toxicity endpoint was partly based on the effects in females. There are no TTR or DFR data available, so default assumptions were used. Considerations for the dermal exposure assessment are as follows:

Fluindapyr is proposed for agricultural applications to small vine climbing fruit, except fuzzy kiwifruit (subgroup 13-07F); tree nuts (crop group 14-12); soybean; and cereal grains, except rice (crop group 15); and for applications to ornamentals (in residential or public/commercial landscapes or properties, nurseries, and ornamentals in greenhouses) and turf (golf courses, lawns and landscape areas around public/commercial or residential areas, athletic fields, and commercial sod farms). Applications to turf and ornamentals may result in residential handler or post-application dermal exposures.

- 1. Evidence for dermal toxicity in the fluindapyr database:** The unacceptable 21-day dermal toxicity study showed the test compound did not induce any systemic effects except marginally higher incidence of local irritation findings characterized by skin crusts and localized desquamation at the application site in treated groups. Similar location irritation was also seen in the controls. The minor local-irritations findings were not considered adverse as no dose-related response was present.
- 2. Evidence for dermal toxicity in the toxicology database of similar pesticides:** The dermal toxicities of structurally similar pesticides are summarized in the following table.

	Dermal Toxicity
Sedaxane	No adverse effect was seen at 1000 mg/kg/day
Penthiopyrad	No adverse effect was seen at 1000 mg/kg/day
Bixafen	No adverse effect was seen at 1000 mg/kg/day
Isopyrazam	No dermal toxicity study available
Benzovindifluyr	No adverse toxicity was seen at 1000 mg/kg/day
Fluxapyroxad	No adverse effect was seen at 1000 mg/kg/day
Penflufen	No adverse effects was seen at 1000 mg/kg/day

3. Risk assessment considerations:

Residential: All residential handler and post-application dermal MOEs are above the LOC of 100.

Occupational Handler: All occupational handler dermal MOEs are above the LOC.

Occupational Post-application: All occupational post-application dermal MOEs are above the LOC.

Based on a WOE approach, considering all the available fluindapyr hazard and exposure data, the HASPOC recommends that a new dermal toxicity study is not required at this time. This approach included the following considerations: (1) no dermal risk estimates are below the LOC of 100 using an oral POD of 30 mg/kg/day from the two-generation reproduction study and a conservative DAF of 17%; and (2) no adverse effects were seen up to the limit dose (1000 mg/kg/day) in the available dermal toxicity studies for six structurally similar chemicals so a new dermal study is not likely to result in endpoints that are more sensitive than those currently used for risk assessment..

c. Comparative Thyroid Assay

A number of pesticides have been shown to perturb thyroid hormone homeostasis via reduction of circulating thyroid hormones². This perturbation may be the initial, critical effect leading to adverse effects on the developing nervous system^{3,4}. When a chemical causes thyroid effects, there is inherent uncertainty about potential impacts to the developing brain in response to changing thyroid levels. There is also a lack of empirical data on whether pregnant women or the fetus are more or less susceptible, compared to adults, to the impact of chemicals that alter thyroid hormone homeostasis. This gap makes predictions on developmental susceptibility based on data from adult organisms difficult and very uncertain. The current 40 CFR Part 158 Toxicology Data Requirements do not include thyroid hormone measurements during these potentially sensitive lifestages. The EPA has developed guidance for conducting a comparative thyroid assay⁵ that uses a mechanistic approach to generate thyroid-specific data which can

² Hurley et al. 1998. Mode of carcinogenic action of pesticides inducing thyroid follicular cell tumors in rodents. Environ. Health Perspect. 106(8): 437-445.

³ Chan S and Kilby MD. 2000 Thyroid hormone and central nervous system development. J Endocrinol 165:1-8

⁴ Fisher DA. 2000. The importance of early management in optimizing IQ in infants with congenital hypothyroidism. J Pediatr 136:274-274.

⁵ US EPA 2005. Guidance for Thyroid Assays in Pregnant Animals, Fetuses and Postnatal Animals, and Adult Animals. Washington, DC.

address the uncertainties associated with life stage susceptibility and allow for the establishment of PoDs that would be protective of potential effects of thyroid function disruption in pregnant females on the fetus and newborn.

- 1. Evidence for thyroid toxicity in the fluindapyr database:** In the two-generation reproduction study, there was evidence that the thyroid was adversely affected by fluindapyr in the P and F1 parental males and females as indicated by increased incidence of thyroid follicular hypertrophy/hyperplasia. In addition to this thyroid effect, fluindapyr also produced a host of effects in the ovary and uterus. No thyroid finding was seen in the combined chronic/carcinogenicity in rats or carcinogenicity study in mice. However, the thyroid effects are part of the LOAEL and the two-generation reproduction study is relied on for endpoints for risk assessment.
- 2. Evidence for thyroid toxicity in the toxicology database of similar pesticides:** The thyroid toxicity and CTA requirement of structurally similar pesticides are summarized in the following table.

	Thyroid Effects	CTA
Sedaxane	Increased thyroid follicular cell hyperplasia & adenomas in chronic rat study	Waived (A. Wray; TXR 0057539)
Penthiopyrad	Thyroid hypertrophy, incidence thyroid tumors (not treatment relate)	
Bixafen	Thyroid follicular cell hypertrophy and hyperplasia	Not required at this time (M. Wilson, TXR 0057713)
Isopyrazam	Thyroid follicular cell adenomas and carcinomas	
Benzovindiflupyr	Thyroid follicular cell proliferation & thyroid tumor	Waived (S. Dobreniecki, TXR 0057502)
Fluxapyroxad	Thyroid follicular hypertrophy/hyperplasia	No CTA required. Thyroid effect was used as tox endpoint.
Penflufen	Thyroid follicular hypertrophy/hyperplasia	Waived (TXR 0053477).

3. Risk assessment considerations:

Dietary Exposure: The PoD (NOAEL) for acute dietary exposure was 60 mg/kg based on decreased motor activity seen in an acute neurotoxicity study in rats at 125 mg/kg/day (LOAEL). For chronic dietary exposure, the PoD was 4 mg/kg/day based on decreased body weights at 8 mg/kg/day (LOAEL) in 1-year oral toxicity study in dogs.

Based on residue data submitted to the Agency, fluindapyr residues are detected at low levels in the milk (specifically milk fat) of dosed goats. This is evidence that in the two-generation reproductive study in rat, offspring were potentially also exposed to fluindapyr during lactation.

Acute and chronic (non-cancer) dietary exposure estimates are presented in Table 2 of Appendix A. The screening-level acute analyses assumed 100% crop treated (PCT), default and empirical processing factors, and field trial data (highest average field trial values for acute and mean field trial values for chronic). The screening-level chronic analyses further incorporated projected PCT (PCTn) for grape. These residues

incorporate contributions from all residues of concern in crops and livestock, as well as partially refined estimated drinking water concentrations (EDWCs). As 100 PCT was used in the acute assessment, these estimates are at the 95th percentile of exposure. The resulting acute risk estimate for all infants <1 year old (the subpopulation with the greatest risk estimate) was 17% of the aPAD. The chronic risk estimate for all infants <1 year old (the subpopulation with the greatest risk estimate) was 33% of the cPAD.

Residential Exposure: Residential handler dermal exposures were assessed for liquid formulations applied to gardens, trees, and lawns or turf. The MOEs for these scenarios range from 3,000 to 140,000 and are all 10X above the LOC of 100.

Residential inhalation exposures were not assessed, as there is no inhalation hazard from fluindapyr.

Residential post-application scenarios were assessed for gardens, trees, and lawns and turf.

Adult post-application dermal exposures for gardens and trees are estimated at an MOE of 880 (<10x the LOC of 100), and dermal exposures to children 6 to <11 years are estimated at an MOE of 1500 (>10x the LOC of 100).

Adult MOEs for post-application dermal exposures to lawns and turf are all above 10x the LOC of 100 (minimum MOE 7300). The greatest estimated exposures for other indicator lifestages are MOEs of 880 for children 1 to <2 (high contact lawn activities), 19,000 for youth 11 to <16 (golfing), and 16,000 for children 6 to <11 (golfing). Of these, the MOE for children 1 to <2 years old from high contact lawn activities is <10x the LOC of 100.

Child dermal and hand-to-mouth exposures from post-application exposure to residential turf resulted in a combined MOE of 790, which is <10x the LOC of 100.

Occupational Handler: The majority of occupational handler dermal MOEs are above 10 times the LOC considering the proposed clothing and PPE of gloves, with the following exceptions:

- Applying sprays via airblast to orchard/vineyard crops. MOE = 880
 - o Double layer and gloves MOE = 940.
 - o Single layer and gloves with chemical-resistant headgear MOE = 6500
- Mixing/loading/applying liquids by mechanically pressurized handgun to orchard/vineyard crops. MOE = 270; greenhouse ornamentals. MOE = 780; nursery ornamentals or landscaping ornamentals. MOE = 940; typical field crops. MOE = 480.
 - o Double layer and gloves MOEs are estimated at 410, 1200, 1400 and 720, respectively. Thus, M/L/A liquids by mechanically pressurized handgun to orchard/vineyard crops and to typical field crops remain of concern considering the highest PPE.

Occupational Post-application: The majority of occupational post-application dermal MOEs are above 10 times the LOC at day zero (or day 5 for girdling and turning table grapes, as is the proposed REI on the label for these activities), with the following exceptions:

- Hand harvesting and detasseling for sweet corn. MOE = 490
- Tying/training, hand harvesting, leaf pulling for wine and juice grapes. MOE = 250.
- Girdling and turning table grapes. MOE = 220 on day 5.
- Tying/training, hand harvesting, leaf pulling table grapes/raisins. MOE = 450

Based on a WOE approach, considering all the available fluindapyr hazard and exposure data, the HASPOC recommends that a comparative thyroid assay (comparing pregnant animals, fetuses, postnatal animals, and adult animals) is required at this time. This approach included the following considerations: (1) the overall hazard profile of fluindapyr showed evidence of thyroid toxicity (hypertrophy/hyperplasia/hyperplasia; (2) the combined dietary and drinking water estimates are all greater than 10% of the cPAD; and (3) several occupational exposure assessments and a few residential post-application exposure assessments yielded MOE's below 10x LOC of 100.

In the absence of this study, a 10X database uncertainty factor will be applied for assessing all risk scenarios until a CTA is submitted or other information is provided to support a waiver.

IV. HASPOC CONCLUSIONS

Based on a WOE approach, considering all the available hazard and exposure data for fluindapyr, the HASPOC recommends that the immunotoxicity study and the dermal toxicity study for fluindapyr are **not required** at this time, and the comparative thyroid assay for fluindapyr **is required** at this time.

V. APPENDIX A

Table A.1. Summary of Toxicological Doses and Endpoints for Fluindapyr for Human Health Risk Assessments.

Exposure/ Scenario	Point of Departure	Uncertainty/FQPA Safety Factors	RfD, PAD, LOC for Risk Assessment	Study and Toxicological Effects
Acute Dietary (General Population, including Infants and Children)	NOAEL= 60 mg/kg	UF _A = 10x UF _H = 10x FQPA SF= 1x	Acute RfD = aPAD =0.6 mg/kg/day	Acute neurotoxicity study LOAEL = 125 mg/kg based on decreased total and ambulatory motor activities in both sexes, and decreased rearing in females on Day 0.
Chronic Dietary (All Populations)	NOAEL= 4 mg/kg/day	UF _A = 10x UF _H = 10x FQPA SF= 1x	Chronic RfD = cPAD = 0.04 mg/kg/day	1-year oral toxicity in dogs (capsule) LOAEL = 8 mg/kg/day based decreased body weight (↓10-15%) and increased incidence of bile duct hyperplasia.
Incidental Oral Short-Term (1-30 days)	NOAEL= 30 mg/kg/day	UF _A = 10x UF _H = 10x FQPA SF= 1x	LOC = 100	Two-generation reproduction study in rat LOAEL =142 mg/kg/day based on offspring, parental, and reproductive effects ⁺
Dermal Short (1-30-days)- and Intermediate- Term (1-6 months)	NOAEL= 30 mg/kg/day DAF = 17%	UF _A = 10x UF _H = 10x FQPA SF= 1x	LOC = 100	Two-generation reproduction study in rat LOAEL =142 mg/kg/day based on offspring, parental, and reproductive effects ⁺
Inhalation Short- (1-30 days) and Intermediate- Term (1-6 months)	In a 28-day inhalation in rats, no adverse effect was found at 0.98 mg/kg which was essentially the limit exposure concentration (1 mg/L), and no inhalation toxicity endpoint and PoD could be established. Therefore, inhalation exposure assessment was not warranted.			
Cancer (oral, dermal, inhalation)	No likely to be carcinogenic to human. Cancer risk assessment is not required.			

⁺: Off spring effects: decrease F1 & F2 pup body weights, and decreases in thymus and spleen weights

Parental effects: increased incidence of thyroid hyperplasia/ hypertrophy.

Reproductive effects: corpora lutea vacuolation, increase epithelium mucification, increase anestrus epithelium of the vagina, delayed vaginal opening, and decrease in antral follicle counts, increase in seminal vesicle weight, decreases in ovary and uterine weights, and attenuated endometrium.

Table A.2. Summary of Dietary (Food and Drinking Water) Exposure and Risk for Fluindapyr. ¹						
Population Subgroup	Acute Dietary (95th Percentile)		Chronic Dietary		Cancer	
	Dietary Exposure (mg/kg/day)	% aPAD*	Dietary Exposure (mg/kg/day)	% cPAD*	Dietary Exposure (mg/kg/day)	Risk
General U.S. Population	0.035088	5.9	0.009169	23	NA	NA
All Infants (<1 year old)	0.101739	17	0.022554	56		
Children 1-2 years old	0.061753	10	0.015671	39		
Children 3-5 years old	0.049023	8.2	0.012836	32		
Children 6-12 years old	0.034707	5.8	0.008765	22		
Youth 13-19 years old	0.027790	4.6	0.006738	17		
Adults 20-49 years old	0.032828	5.5	0.008884	22		
Adults 50-99 years old	0.029383	4.9	0.008758	22		
Females 13-49 years old	0.033457	5.6	0.008813	22		

* The subpopulation with the highest risk estimates in bold.

¹ Assessments includes all uses on the proposed labels and EDWCs using degradant inputs.

Residential Exposures

Residential Handler: All residential handler MOEs are above 10 times the LOC of 100 (all MOEs > 1,000).

Table A.3. Residential Handler Exposure and Risk Estimates								
Scenario	Formulation	Application Equipment/Method	Application Rate	Units	Area Treated or Amount Handled Daily	Units (per day)	Dermal MOE	Dermal MOE (Rounded)
Gardens / Trees	Liquid concentrate	Manually-pressurized handwand	0.00627907	lb ai/gallon	5	gallons	6156	6200
Gardens / Trees	Liquid concentrate	Manually-pressurized handwand	0.0000063	lb ai/ft ²	1200	ft ²	25566	26000
Gardens / Trees	Liquid concentrate	Hose-end Sprayer	0.0000063	lb ai/ft ²	1200	ft ²	27770	28000
Gardens / Trees	Liquid concentrate	Hose-end Sprayer	0.00627907	lb ai/gallon	11	gallons	3040	3000
Lawns / Turf	Liquid concentrate	Hose-end Sprayer	0.27	lb ai/acre	0.5	acres	6731	6700
Lawns / Turf	Liquid concentrate	Manually-pressurized handwand	0.00627907	lb ai/gallon	5	gallons	6156	6200
Gardens / Trees	Liquid concentrate	Backpack	0.0000063	lb ai/ft ²	1200	ft ²	12390	12000
Gardens / Trees	Liquid concentrate	Backpack	0.0027	lb ai/gallon	5	gallons	6938	6900
Gardens / Trees	Liquid concentrate	Sprinkler can	0.0000063	lb ai/ft ²	1200	ft ²	27770	28000
Gardens / Trees	Liquid concentrate	Sprinkler can	0.00627907	lb ai/gallon	5	gallons	6687	6700
Lawns / Turf	Liquid concentrate	Sprinkler can	0.0000063	lb ai/ft ²	1000	ft ²	144237	140000
Lawns / Turf	Liquid concentrate	Backpack	0.00627907	lb ai/gallon	5	gallons	2983	3000

Residential Post-Application:

For post-application dermal exposures, two scenarios result in dermal MOEs below 10 times the LOC of 100: Adults at 880, following applications to ornamentals; and children 1 to <2 at 880 for high contact lawn activities following applications to turf.

Gardens and Trees Information:

Table A.4. Residential Post-Application Exposure and Risk Estimates for Gardens and Trees									
Gardens									
Formulation	Lifestage	DFR _t (ug/cm ²)	Weight unit conversion factor (mg/ug)	Transfer Coefficient (cm ² /hr)	Exposure Time (hr)	Exposure (mg/day)	Absorbed Dermal Dose (mg/kg-day)	Dermal MOE	Dermal MOE (rounded)
Liquids	Adult	0.750	0.001	8,400	2.2	13.865	0.034	878.23	880
	6 < 11 yrs	0.750	0.001	4,600	1.1	3.796	0.020	1487.51	1500

Turf Information:

Table A.5. Residential Post-Application Exposure and Risk Estimates for Turf									
High Contact Lawn Activities									
Formulation	Lifestage	TTR _t (ug/cm ²)	Weight unit conversion factor (mg/ug)	Transfer Coefficient (cm ² /hr)	Hours of Exposure (hr)	Exposure (mg/day)	Absorbed Dose (mg/kg/day)	Dermal MOE	Dermal MOE (rounded)
Liquids	Adult	0.03	0.001	180,000	1.5	8.10	0.02	1502.74	1500
	1 to <2 years	0.03	0.001	49,000	1.5	2.21	0.03	880.04	880
Mowing Turf									
Formulation	Lifestage	TTR _t (ug/cm ²)	Weight unit conversion factor (mg/ug)	Transfer Coefficient (cm ² /hr)	Hours of Exposure (hr)	Exposure (mg/day)	Absorbed Dose (mg/kg/day)	Dermal MOE	Dermal MOE (rounded)
Liquids	Adult	0.03	0.001	5,500	1	0.1651	0.000406664	73770.97	74000
	11 to <16 years	0.03	0.001	4,500	1	0.1350	0.000402773	74483.73	74000
Golfing									
Formulation	Lifestage	TTR _t (ug/cm ²)	Weight unit conversion factor (mg/ug)	Transfer Coefficient (cm ² /hr)	Hours of Exposure (hr)	Exposure (mg/day)	Absorbed Dose (mg/kg/day)	Dermal MOE	Dermal MOE (rounded)
Liquids	Adult	0.03	0.001	5,300	4	0.6362	0.001567505	19138.70	19000
	11 to <16 years	0.03	0.001	4,400	4	0.5282	0.001575288	19044.14	19000
	6 to <11 years	0.03	0.001	2,900	4	0.3481	0.001849397	16221.50	16000

HtM Exposure												
Formulation	Lifestage	HR _t	F _M	SA _H (cm ²)	Exposure Time (hours/day)	N_Replen	SE	Freq Ht M	Exposure (mg/day)	Absorbed Dose (mg/kg/day)	MOE	MOE (rounded)
		Hand Residue (mg/cm ²)	Fraction of Hand Surface Area Mouthed / Event			Number of replenishment intervals per hr (intervals/hr)	Extraction by Saliva	HtM events per hour				
Liquid	1 to <2 years	0.00044	0.127	150	1.5	4	0.48	13.9	0.0452	0.0041	7296.5274 3	7300

Residential MOEs for consideration for aggregate:

- Adults: The recommended residential exposure for use in the adult aggregate assessment is post-application dermal exposure to residential ornamental gardens.
- Youth 11 <16 years old: The recommended residential exposure for use in the youth aggregate assessment is post-application dermal exposure from golfing activities.
- Children 6 <11 years old: The recommended residential exposure for use in the child 6<11 year old assessment is post-application dermal exposure to residential ornamental gardens.
- Children 1<2 years old: The recommended residential exposure for use in the children 1<2 years old aggregate assessment is dermal and hand-to-mouth exposures from post-application exposure to residential turf.

Since dermal and incidental oral exposure routes share a common toxicological endpoint, risk estimates have been combined for those routes. The incidental oral scenarios (i.e., hand-to-mouth and object-to-mouth) should be considered inter-related and it is likely that they occur interspersed amongst each other across time. Combining these scenarios with the dermal exposure scenario would be overly-conservative because of the conservative nature of each individual assessment. Therefore, the post-application exposure scenarios that were combined for children 1 < 2 years old are the dermal and hand-to-mouth scenarios. This combination should be considered a protective estimate of children's exposure.

Aggregate Exposures

Table A.6. Recommendations for the Residential Exposures for the Fluindapyr Aggregate Assessment.									
Lifestage	Exposure Scenario	Dose (mg/kg/day) ¹				MOE ²			
		Dermal	Inhalation	Oral	Total	Dermal	Inhalation	Oral	Total ³
Adult	Post-application exposure to residential ornamental gardens	0.034	N/A	N/A	0.034	880	N/A	N/A	880
Youth 11 <16 years old	Post-application exposure from golfing activities	0.0016	N/A	N/A	0.0016	19000	N/A	N/A	19000
Child 6<11 years old	Post-application exposure to residential ornamental gardens	0.020	N/A	N/A	0.020	1500	N/A	N/A	1500
Child 1<2 years old	Post-application exposure to treated Residential lawns	0.034	N/A	0.0041	0.038	880	N/A	7300	790

1 Dose = the highest dose for each applicable lifestage of all residential scenarios assessed. Total = dermal + inhalation + incidental oral (where applicable).

2 MOE = POD (mg/kg/day) ÷ Dose (mg/kg/day).

3 Combined MOE = 1 ÷ [(1/dermal MOE) + (1/inhalation MOE) + (1/incidental oral MOE)], where applicable.

Occupational Exposures

Exposure Scenario	Crop or Target	Dermal Unit Exposure (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate	App Rate Unit	Area Treated or Amount Handled Daily	Area Treated/Amount Handled Unit	Dermal	
								Dose (mg/kg/day)	MOE
Mixer/Loader									
Liquid, Aerial, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	37.6	SL/G	0.27	lb ai/acre	60	acres	0.0015	20000
Liquid, Aerial, Broadcast	Orchard/Vineyard	37.6	SL/G	0.219	lb ai/acre	350	acres	0.0071	4200
Liquid, Aerial, Broadcast	Sod	37.6	SL/G	0.27	lb ai/acre	350	acres	0.00875	3400
Liquid, Aerial, Broadcast	Field crop, typical	37.6	SL/G	0.125	lb ai/acre	350	acres	0.00407	7400
Liquid, Aerial, Broadcast	Field crop, high-acreage	37.6	SL/G	0.134	lb ai/acre	1200	acres	0.0149	2000
Liquid, Airblast, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	37.6	SL/G	0.27	lb ai/acre	20	acres	0.0005	60000
Liquid, Airblast, Broadcast	Orchard/Vineyard	37.6	SL/G	0.219	lb ai/acre	40	acres	0.000811	37000
Liquid, Chemigation, Broadcast	Orchard/Vineyard	37.6	SL/G	0.219	lb ai/acre	350	acres	0.0071	4200
Liquid, Chemigation, Broadcast	Sod	37.6	SL/G	0.27	lb ai/acre	350	acres	0.00875	3400
Liquid, Chemigation, Broadcast	Field crop, typical	37.6	SL/G	0.125	lb ai/acre	350	acres	0.00407	7400
Liquid, Chemigation, Broadcast	Field crop, high-acreage	37.6	SL/G	0.134	lb ai/acre	350	acres	0.00434	6900
Liquid, Chemigation, Broadcast	Greenhouse (ornamentals, roses, cut flowers, container stock, vegetables)	37.6	SL/G	0.27	lb ai/acre	60	acres	0.0015	20000
Liquid, Chemigation, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	37.6	SL/G	0.27	lb ai/acre	60	acres	0.0015	20000
Liquid, Groundboom, Broadcast	Landscaping, turf (lawns, athletic fields, parks, etc.)	37.6	SL/G	0.27	lb ai/acre	5	acres	0.000125	240000
Liquid, Groundboom, Broadcast	Golf course (fairways, tees, greens)	37.6	SL/G	0.27	lb ai/acre	40	acres	0.001	30000
Liquid, Groundboom, Broadcast	Field-grown ornamental crops	37.6	SL/G	0.27	lb ai/acre	40	acres	0.001	30000
Liquid, Groundboom, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	37.6	SL/G	0.27	lb ai/acre	60	acres	0.0015	20000
Liquid, Groundboom, Broadcast	Greenhouse (ornamentals, roses, cut flowers, container stock, vegetables)	37.6	SL/G	0.27	lb ai/acre	60	acres	0.0015	20000

Table A.7. Occupational Handler Non-Cancer Exposure and Risk Estimates for Fluindapyr.									
Exposure Scenario	Crop or Target	Dermal Unit Exposure (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate	App Rate Unit	Area Treated or Amount Handled Daily	Area Treated/Amount Handled Unit	Dermal	
								Dose (mg/kg/day)	MOE
Liquid, Groundboom, Broadcast	Sod	37.6	SL/G	0.27	lb ai/acre	80	acres	0.002	15000
Liquid, Groundboom, Broadcast	Orchard/Vineyard	37.6	SL/G	0.219	lb ai/acre	40	acres	0.000811	37000
Liquid, Groundboom, Broadcast	Field crop, typical	37.6	SL/G	0.125	lb ai/acre	80	acres	0.000926	32000
Liquid, Groundboom, Broadcast	Field crop, high-acreage	37.6	SL/G	0.125	lb ai/acre	200	acres	0.00232	13000
Applicator									
Spray (all starting formulations), Aerial, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	2.08	EC	0.27	lb ai/acre	60	acres	0.000083	360000
Spray (all starting formulations), Aerial, Broadcast	Orchard/Vineyard	2.08	EC	0.219	lb ai/acre	350	acres	0.000392	77000
Spray (all starting formulations), Aerial, Broadcast	Sod	2.08	EC	0.27	lb ai/acre	350	acres	0.000485	62000
Spray (all starting formulations), Aerial, Broadcast	Field crop, typical	2.08	EC	0.125	lb ai/acre	350	acres	0.000224	130000
Spray (all starting formulations), Aerial, Broadcast	Field crop, high-acreage	2.08	EC	0.125	lb ai/acre	1200	acres	0.000769	39000
Spray (all starting formulations), Airblast, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	1590	SL/G	0.27	lb ai/acre	20	acres	0.0212	1400
Spray (all starting formulations), Airblast, Broadcast	Orchard/Vineyard	1590	SL/G	0.219	lb ai/acre	40	acres	0.0342	880
Spray (all starting formulations), Airblast, Broadcast	Orchard/Vineyard	1480	DL/G	0.219	lb ai/acre	40	acres	0.032	940
Spray (all starting formulations), Airblast, Broadcast	Orchard/Vineyard	215	SL/G/CRH	0.219	lb ai/acre	40	acres	0.00463	6500
Spray (all starting formulations), Groundboom, Broadcast	Landscaping, turf (lawns, athletic fields, parks, etc.)	16.1	SL/G	0.27	lb ai/acre	5	acres	0.0000535	560000
Spray (all starting formulations), Groundboom, Broadcast	Golf course (fairways, tees, greens)	16.1	SL/G	0.27	lb ai/acre	40	acres	0.000429	70000
Spray (all starting formulations), Groundboom, Broadcast	Field-grown ornamental crops	16.1	SL/G	0.27	lb ai/acre	40	acres	0.000429	70000

Table A.7. Occupational Handler Non-Cancer Exposure and Risk Estimates for Fluindapyr.									
Exposure Scenario	Crop or Target	Dermal Unit Exposure (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate	App Rate Unit	Area Treated or Amount Handled Daily	Area Treated/Amount Handled Unit	Dermal	
								Dose (mg/kg/day)	MOE
Spray (all starting formulations), Groundboom, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	16.1	SL/G	0.27	lb ai/acre	60	acres	0.000643	47000
Spray (all starting formulations), Groundboom, Broadcast	Greenhouse (ornamentals, roses, cut flowers, container stock, vegetables)	16.1	SL/G	0.27	lb ai/acre	60	acres	0.000643	47000
Spray (all starting formulations), Groundboom, Broadcast	Sod	16.1	SL/G	0.27	lb ai/acre	80	acres	0.000857	35000
Spray (all starting formulations), Groundboom, Broadcast	Orchard/Vineyard	16.1	SL/G	0.219	lb ai/acre	40	acres	0.000347	86000
Spray (all starting formulations), Groundboom, Broadcast	Field crop, typical	16.1	SL/G	0.125	lb ai/acre	80	acres	0.000397	76000
Spray (all starting formulations), Groundboom, Broadcast	Field crop, high-acreage	5.1	EC	0.125	lb ai/acre	200	acres	0.000315	95000
Flagger									
Spray (all starting formulations), Aerial, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	12	SL/G	0.27	lb ai/acre	60	acres	0.000478	63000
Spray (all starting formulations), Aerial, Broadcast	Orchard/Vineyard	12	SL/G	0.219	lb ai/acre	350	acres	0.00227	13000
Spray (all starting formulations), Aerial, Broadcast	Sod	12	SL/G	0.27	lb ai/acre	350	acres	0.00278	11000
Spray (all starting formulations), Aerial, Broadcast	Field crop, typical	12	SL/G	0.125	lb ai/acre	350	acres	0.00129	23000
Spray (all starting formulations), Aerial, Broadcast	Field crop, high-acreage	12	SL/G	0.125	lb ai/acre	350	acres	0.00129	23000
Mixer/Loader/Applicator									
Liquid, Backpack, Ground/soil-directed	Orchard/Vineyard	8260	SL/G	0.0219	lb ai/gallon solution	40	gallons solution	0.0178	1700
Liquid, Backpack, Broadcast	Greenhouse (ornamentals, roses, cut flowers, container stock, vegetables)	11200	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.00692	4300
Liquid, Backpack, Broadcast (foliar)	Nursery (ornamentals, vegetables, trees, container stock)	30500	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.0189	1600
Liquid, Backpack, Ground/soil-directed	Nursery (ornamentals, vegetables, trees, container stock)	8260	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.0051	5900
Liquid, Backpack, Broadcast (foliar)	Landscaping, trees/shrubs/bushes	30500	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.0189	1600

Exposure Scenario	Crop or Target	Dermal Unit Exposure (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate	App Rate Unit	Area Treated or Amount Handled Daily	Area Treated/Amount Handled Unit	Dermal	
								Dose (mg/kg/day)	MOE
Liquid, Backpack, Broadcast (foliar)	Landscaping, plants/flowers	30500	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.0189	1600
Liquid, Backpack, Broadcast	Landscaping, turf (lawns, athletic fields, parks, etc.)	30500	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.0189	1600
Liquid, Backpack, Spot	Landscaping, turf (lawns, athletic fields, parks, etc.)	8260	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.0051	5900
Liquid, Manually-pressurized Handwand, Broadcast	Greenhouse (ornamentals, roses, cut flowers, container stock, vegetables)	430	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.000266	110000
Liquid, Manually-pressurized Handwand, Broadcast (foliar)	Nursery (ornamentals, vegetables, trees, container stock)	430	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.000266	110000
Liquid, Manually-pressurized Handwand, Broadcast (foliar)	Landscaping, trees/shrubs/bushes	430	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.000266	110000
Liquid, Manually-pressurized Handwand, Broadcast (foliar)	Landscaping, plants/flowers	430	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.000266	110000
Liquid, Manually-pressurized Handwand, Broadcast	Landscaping, turf (lawns, athletic fields, parks, etc.)	430	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.000266	110000
Liquid, Manually-pressurized Handwand, Broadcast (foliar)	Interior landscaping	430	SL/G	0.00627907	lb ai/gallon solution	40	gallons solution	0.000266	110000
Liquid, Mechanically-pressurized Handgun, Broadcast (foliar)	Orchard/Vineyard	2050	SL/G	0.0219	lb ai/gallon solution	1000	gallons solution	0.111	270
Liquid, Mechanically-pressurized Handgun, Broadcast (foliar)	Orchard/Vineyard	1360	DL/G	0.0219	lb ai/gallon solution	1000	gallons solution	0.0734	410
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Orchard/Vineyard	2050	SL/G	0.0219	lb ai/gallon solution	1000	gallons solution	0.111	270
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Orchard/Vineyard	1360	DL/G	0.0219	lb ai/gallon solution	1000	gallons solution	0.0734	410
Liquid, Mechanically-pressurized Handgun, Broadcast	Greenhouse (ornamentals, roses, cut flowers, container stock, vegetables)	2500	SL/G	0.00627907	lb ai/gallon solution	1000	gallons solution	0.0387	780
Liquid, Mechanically-pressurized Handgun, Broadcast	Greenhouse (ornamentals, roses, cut flowers, container stock, vegetables)	1600	DL/G	0.00627907	lb ai/gallon solution	1000	gallons solution	0.0246	1200
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Greenhouse (ornamentals, roses, cut flowers, container stock, vegetables)	2500	SL/G	0.00627907	lb ai/gallon solution	1000	gallons solution	0.0387	780

Table A.7. Occupational Handler Non-Cancer Exposure and Risk Estimates for Fluindapyr.									
Exposure Scenario	Crop or Target	Dermal Unit Exposure (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate	App Rate Unit	Area Treated or Amount Handled Daily	Area Treated/Amount Handled Unit	Dermal	
								Dose (mg/kg/day)	MOE
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Greenhouse (ornamentals, roses, cut flowers, container stock, vegetables)	1600	DL/G	0.00627907	lb ai/gallon solution	1000	gallons solution	0.0246	1200
Liquid, Mechanically-pressurized Handgun, Broadcast	Golf course (fairways, tees, greens)	880	SL/G	0.27	lb ai/acre	5	acres	0.00293	10000
Liquid, Mechanically-pressurized Handgun, Broadcast (foliar)	Field crop, typical	2050	SL/G	0.0125	lb ai/gallon solution	1000	gallons solution	0.0631	480
Liquid, Mechanically-pressurized Handgun, Broadcast (foliar)	Field crop, typical	1360	DL/G	0.0125	lb ai/gallon solution	1000	gallons solution	0.0419	720
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Field crop, typical	2050	SL/G	0.0125	lb ai/gallon solution	1000	gallons solution	0.0631	480
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Field crop, typical	1360	DL/G	0.0125	lb ai/gallon solution	1000	gallons solution	0.0419	720

Table A.8. Post-Application Occupational Exposures for Fluindapyr.								
Crop	Crop Height	Foliage Density	Application Rate	Activity	Transfer Coefficient (cm ² /hr or gm/hr)	Residue (ug/cm ² or ug/gm)	Dose (mg/kg-day)	MOE
			(lb ai/acre)		Day after Treatment (Day 0; except for turning, girdling activities where Day 5 presented)			
Almond	HIGH	FULL	0.141	Orchard maintenance	100	0.40	0.001	38000
Almond	HIGH	FULL	0.141	Harvesting, Mechanical (shaking)	190	0.40	0.001	20000
Almond	HIGH	FULL	0.141	Scouting	580	0.40	0.005	6600
Almond	HIGH	FULL	0.141	Poling	100	0.40	0.001	38000
Almond	LOW	MIN	0.141	Transplanting	230	0.40	0.002	17000
Barley	LOW	FULL	0.125	Scouting	1100	0.35	0.008	3900
Barley	LOW	MIN	0.125	Scouting	1100	0.35	0.008	3900
Corn, field	HIGH	FULL	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, field	HIGH	FULL	0.125	Scouting	1100	0.35	0.008	3900
Corn, field	LOW	MIN	0.125	Scouting	210	0.35	0.001	21000
Corn, field	LOW	MIN	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, field	LOW	FULL	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, field	LOW	FULL	0.125	Scouting	210	0.35	0.001	21000
Corn, field	LOW	MIN	0.125	Weeding, Hand	70	0.35	0.000	62000
Corn, field	LOW	FULL	0.125	Weeding, Hand	70	0.35	0.000	62000
Corn, pop	HIGH	FULL	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, pop	HIGH	FULL	0.125	Scouting	1100	0.35	0.008	3900
Corn, pop	LOW	MIN	0.125	Scouting	210	0.35	0.001	21000
Corn, pop	LOW	MIN	0.125	Irrigation (hand set)	1900	0.35	0.013	2300

Corn, pop	LOW	FULL	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, pop	LOW	FULL	0.125	Scouting	210	0.35	0.001	21000
Corn, pop	LOW	MIN	0.125	Weeding, Hand	70	0.35	0.000	62000
Corn, pop	LOW	FULL	0.125	Weeding, Hand	70	0.35	0.000	62000
Corn, sweet, grain	HIGH	FULL	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, sweet, grain	HIGH	FULL	0.125	Scouting	1100	0.35	0.008	3900
Corn, sweet, grain	LOW	FULL	0.125	Scouting	210	0.35	0.001	21000
Corn, sweet, grain	HIGH	FULL	0.125	Detasseling, Hand	8800	0.35	0.061	490
Corn, sweet, grain	HIGH	FULL	0.125	Harvesting, Hand	8800	0.35	0.061	490
Corn, sweet, grain	LOW	MIN	0.125	Weeding, Hand	70	0.35	0.000	62000
Corn, sweet, grain	LOW	MIN	0.125	Scouting	210	0.35	0.001	21000
Corn, sweet, grain	LOW	MIN	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, sweet, grain	LOW	FULL	0.125	Weeding, Hand	70	0.35	0.000	62000
Corn, sweet, processing	HIGH	FULL	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, sweet, processing	HIGH	FULL	0.125	Scouting	1100	0.35	0.008	3900
Corn, sweet, processing	LOW	MIN	0.125	Scouting	210	0.35	0.001	21000
Corn, sweet, processing	LOW	MIN	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, sweet, processing	LOW	FULL	0.125	Irrigation (hand set)	1900	0.35	0.013	2300
Corn, sweet, processing	LOW	FULL	0.125	Scouting	210	0.35	0.001	21000
Corn, sweet, processing	LOW	MIN	0.125	Weeding, Hand	70	0.35	0.000	62000
Corn, sweet, processing	LOW	FULL	0.125	Weeding, Hand	70	0.35	0.000	62000
Golf Course	LOW	FULL	0.27	Maintenance	3700	0.030	0.002	14000
Grape, wine	HIGH	FULL	0.219	Scouting	640	0.61	0.008	3900
Grape, wine	HIGH	FULL	0.219	Tying/Training	10100	0.61	0.122	250
Grape, wine	HIGH	FULL	0.219	Harvesting, Hand	10100	0.61	0.122	250
Grape, wine	HIGH	FULL	0.219	Pruning, Hand	640	0.61	0.008	3900
Grape, wine	HIGH	FULL	0.219	Irrigation (hand set)	1900	0.61	0.023	1300

Grape, wine	HIGH	FULL	0.219	Weeding, Hand	640	0.61	0.008	3900
Grape, wine	HIGH	MIN	0.219	Tying/Training	10100	0.61	0.122	250
Grape, wine	HIGH	MIN	0.219	Scouting	640	0.61	0.008	3900
Grape, wine	LOW	MIN	0.219	Scouting	640	0.61	0.008	3900
Grape, wine	LOW	MIN	0.219	Propagating	640	0.61	0.008	3900
Grape, wine	LOW	MIN	0.219	Transplanting	230	0.61	0.003	11000
Grape, wine	HIGH	FULL	0.219	Leaf Pulling	10100	0.61	0.122	250
Grape, wine	HIGH	FULL	0.219	Bird Control	640	0.61	0.008	3900
Grape, wine	LOW	MIN	0.219	Trellis Repair	640	0.61	0.008	3900
Grape, wine	LOW	MIN	0.219	Tying/Training	10100	0.61	0.122	250
Grape, wine	LOW	FULL	0.219	Tying/Training	10100	0.61	0.122	250
Grape, juice	HIGH	FULL	0.219	Scouting	640	0.61	0.008	3900
Grape, juice	HIGH	FULL	0.219	Tying/Training	10100	0.61	0.122	250
Grape, juice	HIGH	FULL	0.219	Harvesting, Hand	10100	0.61	0.122	250
Grape, juice	HIGH	FULL	0.219	Pruning, Hand	640	0.61	0.008	3900
Grape, juice	HIGH	FULL	0.219	Irrigation (hand set)	1900	0.61	0.023	1300
Grape, juice	HIGH	FULL	0.219	Weeding, Hand	640	0.61	0.008	3900
Grape, juice	HIGH	MIN	0.219	Tying/Training	10100	0.61	0.122	250
Grape, juice	HIGH	MIN	0.219	Scouting	640	0.61	0.008	3900
Grape, juice	LOW	MIN	0.219	Scouting	640	0.61	0.008	3900
Grape, juice	LOW	MIN	0.219	Propagating	640	0.61	0.008	3900
Grape, juice	LOW	MIN	0.219	Transplanting	230	0.61	0.003	11000
Grape, juice	HIGH	FULL	0.219	Leaf Pulling	10100	0.61	0.122	250
Grape, juice	HIGH	FULL	0.219	Bird Control	640	0.61	0.008	3900
Grape, juice	LOW	MIN	0.219	Trellis Repair	640	0.61	0.008	3900
Grape, juice	LOW	MIN	0.219	Tying/Training	10100	0.61	0.122	250
Grape, juice	LOW	FULL	0.219	Tying/Training	10100	0.61	0.122	250

Grape, table	HIGH	FULL	0.219	Girdling	19300	0.36	0.138	220
Grape, table	HIGH	FULL	0.219	Irrigation (hand set)	1900	0.61	0.023	1300
Grape, table	HIGH	FULL	0.219	Scouting	640	0.61	0.008	3900
Grape, table	HIGH	FULL	0.219	Turning	19300	0.36	0.138	220
Grape, table	HIGH	FULL	0.219	Tying/Training	5500	0.61	0.067	450
Grape, table	HIGH	FULL	0.219	Harvesting, Hand	5500	0.61	0.067	450
Grape, table	HIGH	FULL	0.219	Pruning, Hand	640	0.61	0.008	3900
Grape, table	HIGH	FULL	0.219	Leaf Pulling	5500	0.61	0.067	450
Grape, table	HIGH	FULL	0.219	Weeding, Hand	640	0.61	0.008	3900
Grape, table	LOW	MIN	0.219	Tying/Training	5500	0.61	0.067	450
Grape, table	LOW	MIN	0.219	Transplanting	230	0.61	0.003	11000
Grape, raisin	HIGH	FULL	0.219	Irrigation (hand set)	1900	0.61	0.023	1300
Grape, raisin	HIGH	FULL	0.219	Scouting	640	0.61	0.008	3900
Grape, raisin	HIGH	FULL	0.219	Tying/Training	5500	0.61	0.067	450
Grape, raisin	HIGH	FULL	0.219	Harvesting, Hand	5500	0.61	0.067	450
Grape, raisin	HIGH	FULL	0.219	Pruning, Hand	640	0.61	0.008	3900
Grape, raisin	HIGH	FULL	0.219	Leaf Pulling	5500	0.61	0.067	450
Grape, raisin	HIGH	FULL	0.219	Weeding, Hand	640	0.61	0.008	3900
Grape, raisin	LOW	MIN	0.219	Tying/Training	5500	0.61	0.067	450
Grape, raisin	LOW	MIN	0.219	Transplanting	230	0.61	0.003	11000
Macadamia nut	HIGH	FULL	0.141	Pruning, Hand	580	0.40	0.005	6600
Macadamia nut	HIGH	FULL	0.141	Orchard maintenance	100	0.40	0.001	38000
Macadamia nut	HIGH	FULL	0.141	Scouting	580	0.40	0.005	6600
Macadamia nut	LOW	MIN	0.141	Transplanting	230	0.40	0.002	17000
Macadamia nut	HIGH	FULL	0.141	Harvesting, Mechanical (shaking)	190	0.40	0.001	20000
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Harvesting, Hand	230	0.76	0.003	8700

Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Harvesting, Hand	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Irrigation (hand set)	1900	0.76	0.028	1100
Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Irrigation (hand set)	1900	0.76	0.028	1100
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Pruning, Hand	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Pruning, Hand	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Scouting	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Scouting	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Container Moving	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Weeding, Hand	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Weeding, Hand	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Transplanting	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Transplanting	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	MIN	0.27	Grafting	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	MIN	0.27	Harvesting, Hand	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	MIN	0.27	Propagating	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	MIN	0.27	Pruning, Hand	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	MIN	0.27	Transplanting	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	MIN	0.27	Transplanting	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Pinching	230	0.76	0.003	8700
Nursery Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Pinching	230	0.76	0.003	8700

Nursery Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Tying/Training	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Harvesting, Hand	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Harvesting, Hand	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Pruning, Hand	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Pruning, Hand	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Scouting	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Scouting	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Container Moving	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Weeding, Hand	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Weeding, Hand	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Transplanting	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Transplanting	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	MIN	0.27	Grafting	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	MIN	0.27	Harvesting, Hand	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	MIN	0.27	Propagating	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	MIN	0.27	Pruning, Hand	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	MIN	0.27	Transplanting	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	MIN	0.27	Transplanting	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Pinching	230	0.76	0.003	8700
Greenhouse Crop (Ornamentals, Non-bearing Plants)	HIGH	FULL	0.27	Pinching	230	0.76	0.003	8700

Greenhouse Crop (Ornamentals, Non-bearing Plants)	LOW	FULL	0.27	Tying/Training	230	0.76	0.003	8700
Peanut	LOW	FULL	0.141	Irrigation (hand set)	1900	0.40	0.015	2000
Peanut	LOW	FULL	0.141	Scouting	210	0.40	0.002	18000
Peanut	LOW	FULL	0.141	Weeding, Hand	70	0.40	0.001	55000
Peanut	LOW	MIN	0.141	Weeding, Hand	70	0.40	0.001	55000
Pecan	HIGH	FULL	0.141	Harvesting, Mechanical (shaking)	190	0.40	0.001	20000
Pecan	HIGH	FULL	0.141	Poling	100	0.40	0.001	38000
Pecan	HIGH	FULL	0.141	Pruning, Hand	580	0.40	0.005	6600
Pecan	HIGH	FULL	0.141	Orchard maintenance	100	0.40	0.001	38000
Pecan	HIGH	FULL	0.141	Scouting	580	0.40	0.005	6600
Pecan	HIGH	FULL	0.141	Weeding, Hand	100	0.40	0.001	38000
Pecan	LOW	MIN	0.141	Transplanting	230	0.40	0.002	17000
Golf Course	LOW	FULL	0.27	Maintenance, greens only	2500	0.030	0.001	20000
Sod	LOW	FULL	0.27	Maintenance	6700	0.030	0.004	7500
Sod	LOW	FULL	0.27	Harvesting, Slab	6700	0.030	0.004	7500
Sod	LOW	FULL	0.27	Transplanting/Planting	6700	0.030	0.004	7500
Soybean	LOW	FULL	0.109	Scouting	1100	0.31	0.007	4500
Soybean	LOW	FULL	0.109	Weeding, Hand	70	0.31	0.000	71000
Soybean	LOW	MIN	0.109	Scouting	1100	0.31	0.007	4500
Walnut, English	HIGH	FULL	0.141	Harvesting, Mechanical (shaking)	190	0.40	0.001	20000
Walnut, English	HIGH	FULL	0.141	Orchard maintenance	100	0.40	0.001	38000
Walnut, English	HIGH	FULL	0.141	Poling	100	0.40	0.001	38000
Walnut, English	HIGH	FULL	0.141	Scouting	580	0.40	0.005	6600
Walnut, English	HIGH	FULL	0.141	Weeding, Hand	100	0.40	0.001	38000
Walnut, English	LOW	MIN	0.141	Transplanting	230	0.40	0.002	17000
Wheat, spring	LOW	FULL	0.125	Scouting	1100	0.35	0.008	3900
Wheat, spring	LOW	MIN	0.125	Scouting	1100	0.35	0.008	3900

Wheat, spring	LOW	MIN	0.125	Weeding, Hand	70	0.35	0.000	62000
Wheat, spring	LOW	FULL	0.125	Weeding, Hand	70	0.35	0.000	62000
Wheat, winter	LOW	FULL	0.125	Scouting	1100	0.35	0.008	3900
Wheat, winter	LOW	FULL	0.125	Weeding, Hand	70	0.35	0.000	62000
Wheat, winter	LOW	MIN	0.125	Scouting	1100	0.35	0.008	3900
Wheat, winter	LOW	MIN	0.125	Weeding, Hand	70	0.35	0.000	62000

All tables are based on the most up-to-date information available at the time of the HASPOC meeting and are subject to change.